

North Sand Lake Fishery Survey, Burnett County, Wisconsin

2014 - 2015

WBIC Sand Lake – 2495100



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## **Executive Summary**

A survey of North Sand Lake (Burnett County) was conducted during spring 2014 by the Wisconsin Department of Natural Resources. The primary objective of this study was to assess the status of the walleye population. Secondary objectives were to assess largemouth bass, northern pike, and panfish populations.

The 2014 adult walleye population estimate on North Sand Lake (0.3 fish/acre) was lower than Ceded Territory averages. However, this estimate was almost identical to the 2006 estimate (307 fish). The largemouth bass population is dominated by stunted slow-growing fish. The northern pike population in North Sand Lake seems to be stable. The catch rate and average lengths during 2014 were similar to the 2006 survey. Bluegills have a desirable size structure and provide good fishing opportunities on the lake.

Management recommendations include: 1) Monitor the walleye population and success of extended growth stocking. 2) Continue to monitor the largemouth bass fishery for responses to the no minimum size limit change. 3) Monitor impacts of liberalized bass regulations on panfish populations. 5) Continue invasive species monitoring and prevention. 6) Protect and enhance the limited fish habitat.

## Introduction

North Sand Lake is a 962 acre seepage lake in eastern Burnett County that has a mean depth of 24 feet and a maximum depth of 74 feet. It is bordered by Green Lake (west), Mallard Lake (south), Lower Twin Lake (east), and Pine Lake (north).

North Sand Lake is considered an oligotrophic (low productivity) lake. Trophic state index (TSI) is an index for evaluating the trophic state or nutrient condition of lakes (Carlson 1977; Lillie et. al 1993). Long term citizen monitoring data on North Sand Lake indicates it is oligotrophic based on TSI values (WDNR 2015). Between 1993 and 2015, mean secchi measurements were 19.5 ft (SD=2.0) from samples taken near the center of North Sand Lake. Littoral bottom composition in the lake is mainly sand, with some gravel and cobble. Aquatic vegetation can be limited (Bass 2007).

The fishery consists mainly of largemouth bass *Micropterus salmoides*, northern pike *Esox lucius*, walleye *Sander vitreus*, bluegill *Lepomis macrochirus*, and black crappie *Pomoxis nigromaculatus*. Other gamefish and panfish present are smallmouth bass *Micropterus dolomieu*, pumpkinseed *Lepomis microlophus*, yellow perch *Perca flavescens*, and rock bass *Ambloplites rupestris*. Common non-gamefish include brown bullhead *Ameiurus nebulosus*, yellow bullhead *Ameiurus natalis*, and bowfin *Amia calva*. Forage species present in the lake include white sucker *Catostomus commersonii* and bluntnose minnow *Pimephales notatus* (Bass 2007).

Stocking has occurred in North Sand Lake since 1936. Before 1970, several gamefish and panfish species were stocked in the lake. After 1970, walleye have been the main focus of stocking efforts. Recently, walleye have been stocked as both small fingerlings (35/acre) and large fingerlings (14/acre). These stocking have typically occurred on an alternate year basis (Appendix Table 1).

Fisheries management surveys have been conducted in North Sand Lake since 1954. These surveys have focused on assessing the game fish population. Recent surveys include walleye population estimates and creel surveys in 1993, 2000, and 2006, gamefish/ panfish sampling in 2000 and 2006, and fall walleye recruitment surveys in 1993, 2000, 2006, and 2013. This survey focused on assessing the gamefish and panfish populations in North Sand Lake.

## **Methods**

### *Field Sampling*

Spring sampling started in early May following Wisconsin DNR lake sampling protocols (Simonson et al. 2008). Walleye sampling consisted of fyke-netting followed by an electrofishing recapture run. After ice out, fyke nets (4 x 6 ft frame) were set on 2 May. Nets were placed on shorelines favorable for walleye spawning. Six to eight nets were fished until 6 May for a total of 25 net nights. Adult walleye were marked with fin clips before a night electrofishing recapture run occurred on 6 May.

Late spring night electrofishing took place 10 June. Three two-mile gamefish stations were sampled with a focus on collecting largemouth bass. Each two-mile station had a ½-mile index station embedded within it where panfish were collected in addition to gamefish.

A fall walleye recruitment survey was not conducted in the fall of 2014. However, an electrofishing survey did occur on 21 September 2015 after surface water temperature had dropped below 70° F. Walleye less than 12.0 in were collected in the sample.

### *Age and Statistical Analysis*

All walleye, largemouth bass, and smallmouth bass were measured to the nearest half inch. Age structures were collected from walleye and largemouth bass. Scale samples were taken on walleye less than 15.0 in and largemouth bass less than 12.0 in. Dorsal spines were

taken on all larger walleye and largemouth bass sampled. Fish were aged to the outside edge of the structure. Panfish (bluegill, black crappie, yellow perch, and rock bass) were measured to the nearest 0.1 in.

Size structure quality of the species sampled was determined using proportional stock density (PSD) indices (Neumann et al. 2013). The PSD value for a species is the number of fish of a specified length and longer (e.g. 15 in for walleye, 6 in for bluegill) divided by the number of fish of stock length or longer, the result multiplied by 100 (Appendix Table 2). Catch per unit effort (CPE) was calculated as the number of fish captured divided by the appropriate unit of sampling effort for that species (e.g. net night, mile of shoreline). The descending limb of a catch curve regression was used to estimate total annual survival for walleye (Ricker 1975). The von Bertalanffy growth function (Quist et al. 2013) was used to assess changes in growth between surveys for walleye. The walleye population was estimated using the Chapman modification of the Peterson estimator (Pine et al. 2013).

## **Results**

### *Early Spring Fyke-Netting and Electrofishing*

Walleye. The 2014 adult walleye population estimate was 308 fish (C.V. = 0.14) or 0.3/acre. The population remains low when compared to previous estimates (Table 1) and was almost identical to the 2006 estimate (307 fish). The adult walleye density was below the Ceded Territory average for lakes that are sustained by stocking (0.9/acre) (Cichosz 2015). The CPE was 6.5 fish/net night for fyke-net sampling and 4.2 fish/mile for electrofishing.

Adult walleyes ranged in length from 11.7 to 26.7 in (Figure 1). Mean length of male and female walleye were 17.9 in (standard deviation (SD) =1.8) and 21.7 in (SD=2.7),

respectively. PSD was 93 and PSD-20 was 27 for walleye collected during spring 2014, which is similar to the 2000 and 2006 surveys (Figure 2).

The theoretical maximum length of both male and female walleye decreased slightly (within an inch) from the previous surveys (Table 2). Mean length-at-age for male walleye was similar to the 2006 survey and above the 2000 survey and Northern Region average (Figure 3). Mean length-at-age for female walleye was comparable to two previous DNR surveys and above the Northern Region average (Figure 4). Survival of age-4 and older walleye was about 71% based on catch curve analysis (Figure 5). Considering age-2 to age-10 fish, walleye were more abundant in stocked year classes than non-stocked year classes (67%) (Table 4).

*Northern Pike.* A total of 90 northern pike, ranging in length from 13.0 to 29.5 in, were captured during early spring netting. Mean lengths of male and female northern pike captured in 2014 were 19.5 in (SD = 4.5) and 20.0 in (SD = 4.6), respectively. Catch rates were similar for northern pike in 2006 (3.7 fish/net night) and 2014 (3.6 fish/net night). PSD was not calculated for northern pike due to the small sample size.

#### *Late Spring Electrofishing*

*Largemouth Bass.* A total of 191 largemouth bass were collected ranging from 5.5 to 17.5 in. Average length was 9.8 in (SD = 1.9), which was smaller than in 2006 (12.6 in). Largemouth bass catch rate was 31.8 fish/mile in 2014, an increase from the 2006 survey (21.6 fish/mile). Largemouth bass PSD was low at 15, a substantial drop from 65 in 2006 (Figure 6). PSD-15 also dropped from 10 in 2006 to 1 in 2014.

Largemouth bass grew below the Northern Region average at all ages present in the 2014 sample (Figure 7). Age-6 and 7 largemouth bass grew up to 3.2 in less than the Northern Region average. However, this growth is similar to the 2006 survey (Figure 7).

Smallmouth Bass. A total of 12 smallmouth bass were collected ranging from 9.0 to 18.5 in. The 2006 sample consisted of five fish ranging from 15.5 to 17.5 in. The average length in 2014 was 12.1 in (SD = 3.6).

Panfish. A total of 335 bluegill were collected ranging from 1.9 to 9.2 in. The average length was 5.9 in (SD = 1.1). Bluegill comprised 83% of the total panfish catch. PSD was 40 and PSD-8 was 6 for bluegill collected in 2014 which was higher than 2000 and 2006 (Table 3). Bluegill electrofishing CPE was 186.7 fish/mile in 2014 which was similar to the 2000 spring survey (190.5 fish/mile). Thirty-seven pumpkinseed ranging from 3.7 – 7.9 in were captured and comprised 9% of the panfish catch. A total of 29 rock bass were collected, ranging from 3.0 – 8.9 in and comprised 7% of the panfish catch. CPEs for pumpkinseed and rock bass were 24.7fish/mile and 19.3 fish/mile, respectively.

### *Fall Electrofishing*

Young-of-year (YOY) walleye were not detected during fall 2015 sampling. The long term average CPE (1990-2015) for YOY walleye in North Sand Lake is 2.8 fish/mile (N = 12, Figure 8). The catch rate for age-1 fish during 2015 was 0.7 fish/mile.

## **Discussion**

North Sand Lake is mainly a largemouth bass/northern pike fishery with a low density walleye population. The walleye population is primarily sustained through stocking. This fact is evident when looking at the estimated number per age group for 2006 and 2014 samples (shown

in Table 4). The largest year class contributions coincide with stocked years. Bass (2007) noted the same pattern in the 2006 survey. North Sand has primarily been stocked with small walleye fingerlings for the past 20 years. Large fingerling walleyes were stocked in 2010 (0.8/acre), 2012 (3.2/acre) and 2015 (14.0/acre). The contribution of large walleye fingerlings to the fishery is currently unknown.

Natural recruitment has continued to be low since the 2006 survey. Naturally recruited YOY walleye were not captured during 2013 and 2015 fall surveys. Results for 2010 were ambiguous because large fingerlings were stocked in late August 2010 and the recruitment survey occurred in early October. Stocking likely inflated the catch rate based on the average length of fish stocked (6.2 in) and fish captured (6.6 in). During years without stocking, there is very little evidence that natural recruitment has occurred.

North Sand's walleye density has remained low, but stable, since 2006. One benefit of North Sand Lake supporting a low density walleye is excellent growth of walleyes. A small walleye population allows survivors to grow quickly (5.7 in above average for females and 3.0 in for males in 2014). Fish that survive to age-4 are typically above 15 in and 79% of the sample was legal to angling harvest in 2014.

The largemouth bass population is dominated by stunted slow-growing fish. Largemouth bass growth has remained the same since 2006 and the catch rate has increased. Harvest during 2006 only represented 10% of the population and anglers mostly harvested largemouth bass around 15.0 in. If harvest is still focused on fish above 14 in, then anglers are harvesting a small portion of the population. For largemouth bass size structure to improve there will need to be significant harvest of fish from 8.0 to 12.0 in. At this time it is hard to say if the no minimum size limit is having any impact. Current largemouth bass data suggests there is no improvement.



However, the size limit change from a 14 in minimum to no minimum size limit has only been in effect for two fishing seasons. More time is needed to determine whether the regulation change is having the desired effect. The differences in timing/water temperature of the 2014 sample (June 2014 - 70° F) and the 2006 sample (May 2006 – 60° F) may also have affected the number of larger largemouth bass captured. Studies have shown that larger largemouth bass spawn earlier than smaller bass (Miranda and Muncy 1987; Goodgame and Miranda 1993).

The northern pike population in North Sand Lake seems to be stable. The catch rate and average lengths during 2014 were similar to the 2006 survey. This fact suggests that North Sand Lake has sufficient pike habitat for successful reproduction and a stable population.

Bluegill are the most common panfish available to anglers in North Sand Lake. The improved size structure of bluegill is likely a result of increased largemouth bass numbers since 2006. When largemouth bass are present in higher densities, they can control bluegill recruitment and can improve their size structure. Guy and Willis (1990) documented this relationship in the upper Midwest and it is apparent in North Sand Lake at this time.

### **Management Recommendations**

- 1) The current walleye regulation of 15 in minimum, 20 – 24 in protected, one over 24 in and 3 bag limit (the base walleye regulation for the Ceded Territory) should stay in place. Harvest should not be restricted since North Sand lake is a stocked walleye fishery and restrictions would not improve the population.
- 2) Large fingerling walleye were first stocked at a rate over 3.2 fish/acre during 2015. Fall recruitment surveys should be used to monitor survival of these fish and determine if their contribution is meaningful to the walleye fishery (as recommended in Bass 2007). If the next

walleye population estimate is not at a density of 1.0 fish/acre or higher, then consideration should be given to discontinuing stocking.

- 3) The current regulation of no minimum size limit on smallmouth and largemouth bass should continue. This regulation allows anglers to harvest bass at a higher rate. Evaluation of this regulation should take place in eight to ten years to allow for adequate time for effects to take place.
- 4) The northern pike population appears stable compared to the 2006 survey. No specific management actions are recommended for Northern Pike at this time.
- 5) The bluegill size structure has improved since 2006. Future surveys should monitor the impact of a liberalized bass limit on the bluegill/panfish population.
- 6) Prevention and monitoring of invasive species should continue in the lake and at access points. Establishment of future invasive species could be detrimental to this unique system.
- 7) Efforts to increase habitat complexity in North Sand Lake should be strongly encouraged. Input of coarse woody debris, protection/promotion of aquatic vegetation, and maintenance or restoration of 35 foot vegetative buffers are some examples of work that can increase habitat complexity.

### **Acknowledgements**

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## References

- Bass, K. 2007. Population characteristics, and sport and tribal use of largemouth bass, northern pike, and walleye in North Sand Lake, Burnett County, Wisconsin, 2006. WBIC 2495100. Wisconsin Department of Natural Resources
- Carlson, R. 1977. A trophic state index for lakes. *Limnology and Oceanography* 22:361-369.
- Cichosz, T.A. 2015. Wisconsin Department of Natural Resources 2012-2013 Ceded Territory Fishery Assessment Report. Wisconsin Department of Natural Resources. Administrative Report 78, Madison.
- Goodgame, L. S.. and L. E. Miranda. 1993. Early growth and survival of age-0 largemouth bass in relation to parental size and swim-up time. *Transactions of the American Fisheries Society* 122:131-138.
- Guy, C.S. and D.W. Willis. 1990. Structural relationships of largemouth bass and bluegill populations in South Dakota ponds. *North American Journal of Fisheries Management*. 10:338-343.
- Lillie, R.A., S. Graham, and P. Rasmussen. 1993. Trophic state index equations and regional predictive equations for Wisconsin lakes. Bureau of Research – Wisconsin Department of Natural Resources, Research Management Findings, Number 35.
- Miranda, L. E. and R. J. Muncy. 1987. Recruitment of young-of-year largemouth bass in relation to size structure of parental stock. *North American Journal of Fisheries Management* 7:131-137.
- Pine, W.E., J.E. Hightower, L.G. Coggins, M.V. Laretta, and K.H. Pollock. 2013. Design and

analysis of tagging studies. Pages 521-572 in A. V. Zale, D. L. Parrish, and T. M. Sutton, editors. Fisheries techniques, 3rd edition. American Fisheries Society, Bethesda, Maryland.

Quist, M.C., M.A. Pegg, and D.R. DeVries. 2013. Age and growth. Pages 677-731 in A. V. Zale, D. L. Parrish, and T. M. Sutton, editors. Fisheries techniques, 3rd edition. American Fisheries Society, Bethesda, Maryland.

Ricker, W.E. 1975. Computation and interpretation of biological statistics in fish populations. Fisheries Research and Board of Canada Bulletin 191.

Simonson, T., A. Fayram, J. Hennessy, and T. Treska. 2008. Fisheries Assessments - Lakes 2007-09 Sampling Procedures. Wisconsin DNR internal publication. Madison, WI.

WDNR 2015. Citizen monitoring lake water quality database. Available from:

<http://dnr.wi.gov/lakes/CLMN>.

Table 1. Walleye population estimates in North Sand Lake, Burnett County, Wisconsin. P.E. = population estimate, C.V. = Coefficient of Variation.

	1988	1993	2000	2006	2014
P.E.	618	835	697	307	308
C.V.	0.10	0.18	0.28	0.19	0.14
fish/acre	0.6	0.9	0.7	0.3	0.3

Table 2. Adult maximum theoretical length ( $L_{\infty}$ ) and walleye growth rates (k) for male and females based on the von Bertalanffy equation.

Parameter	2000	2006	2014
$L_{\infty}$ (male)	21.9	21.5	20.9
k (male)	0.21	0.45	0.64
$L_{\infty}$ (female)	24.8	25.1	24.4
k (female)	0.44	0.38	0.35

Table 3. Bluegill PSD and PSD-8 from electrofishing in North Sand Lake, Burnett County, Wisconsin. \* Represents fish that were collected during a fall survey.

	2000	2006*	2014
PSD	34	8	40
PSD-8	3	0	6

Table 4. Estimated number at age for 2006 and 2014 walleye samples in North Sand Lake, Burnett County, Wisconsin. Numbers-at-age in bold represent year classes that coincide with stocked years.

Age	2006	2014
2	<b>0</b>	<b>14</b>
3	<b>12</b>	0
4	<b>43</b>	<b>93</b>
5	17	10
6	<b>57</b>	<b>19</b>
7	0	10
8	<b>15</b>	<b>24</b>
9	0	<b>9</b>
10	<b>28</b>	<b>3</b>

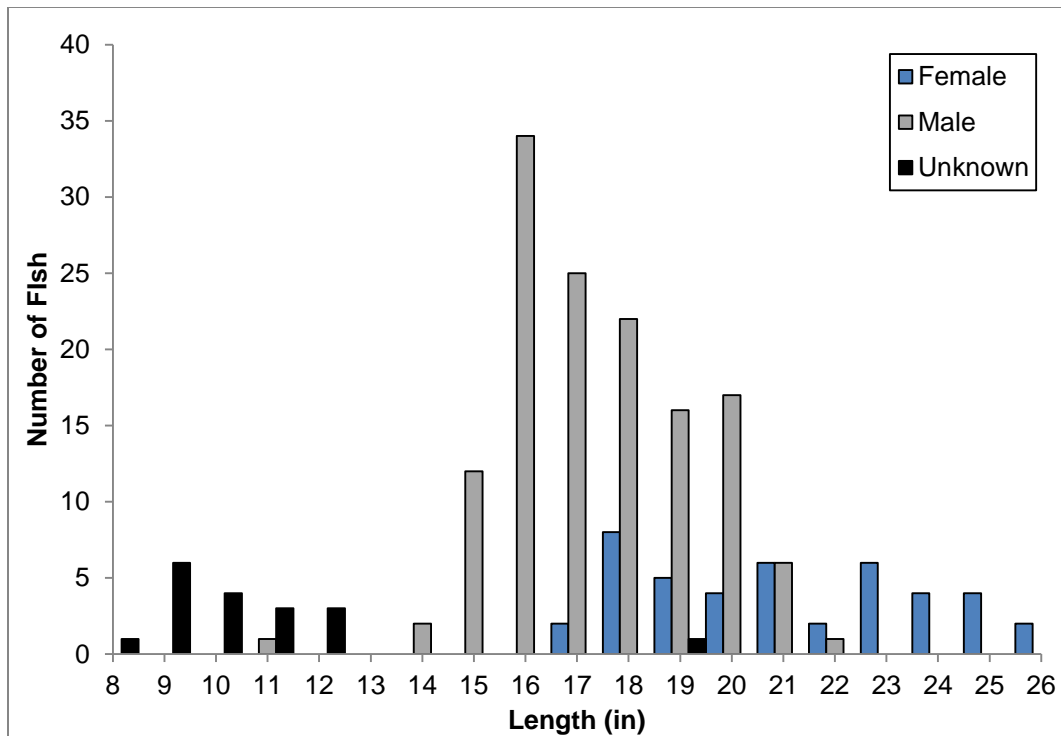


Figure 1. - Length frequency of male, female, and unknown sex walleye collected in North Sand Lake, Burnett County during spring 2014.

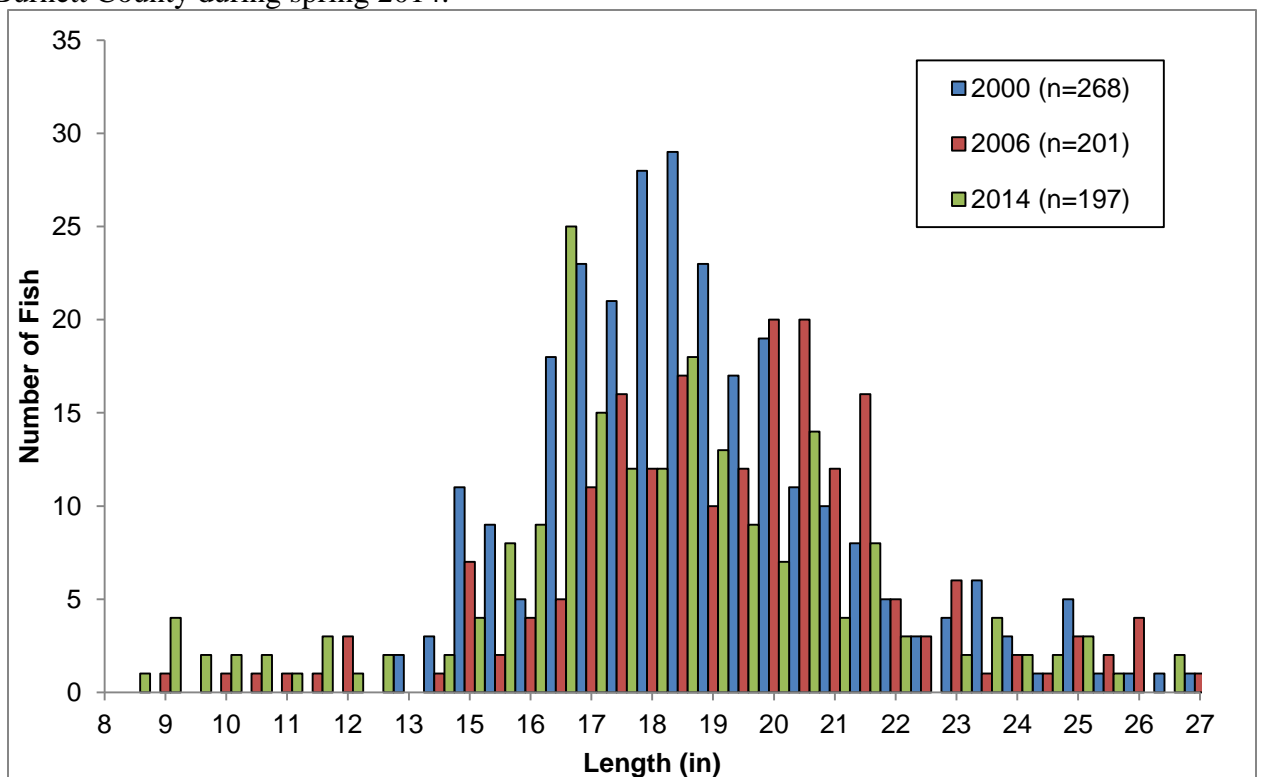


Figure 2. - Length frequency of walleye collected in North Sand Lake, Burnett County in spring 2000, 2006, and 2014.

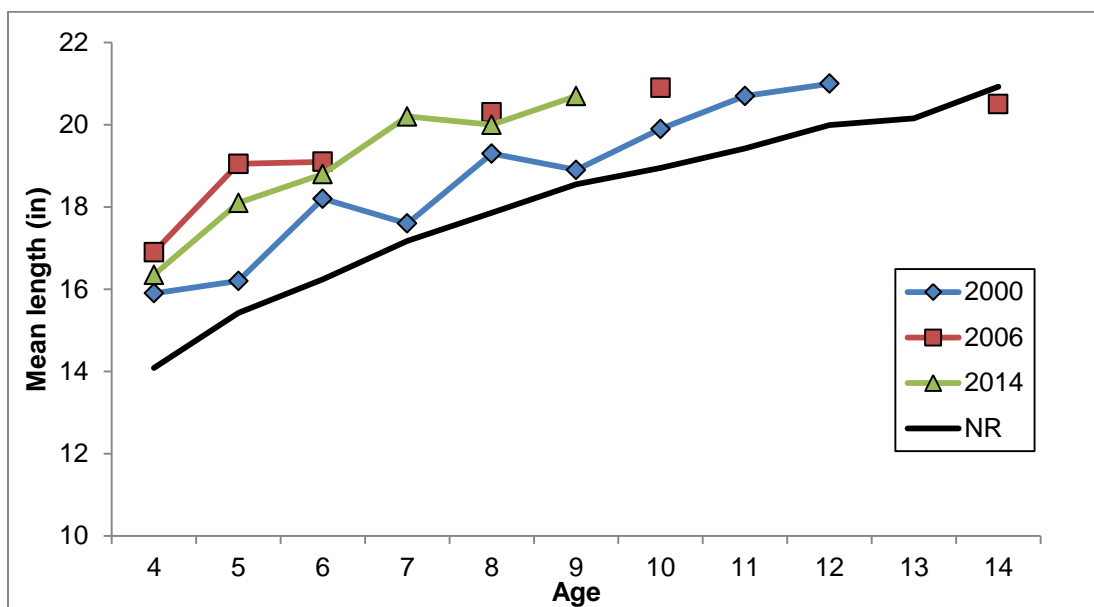


Figure 3. Mean length-at-age for male walleye captured on North Sand Lake, Burnett County in 2000, 2006, and 2014. The black line (NR) represents the Northern Region average.

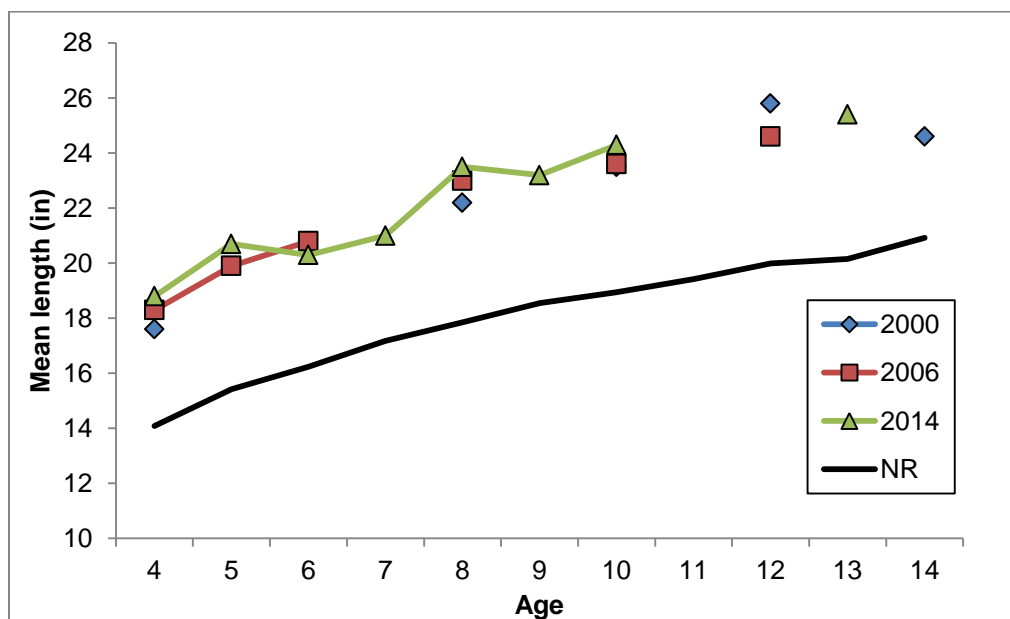


Figure 4. Mean length-at-age for female walleye captured on North Sand Lake, Burnett County in 2000, 2006, and 2014. The black line (NR) represents the Northern Region average.

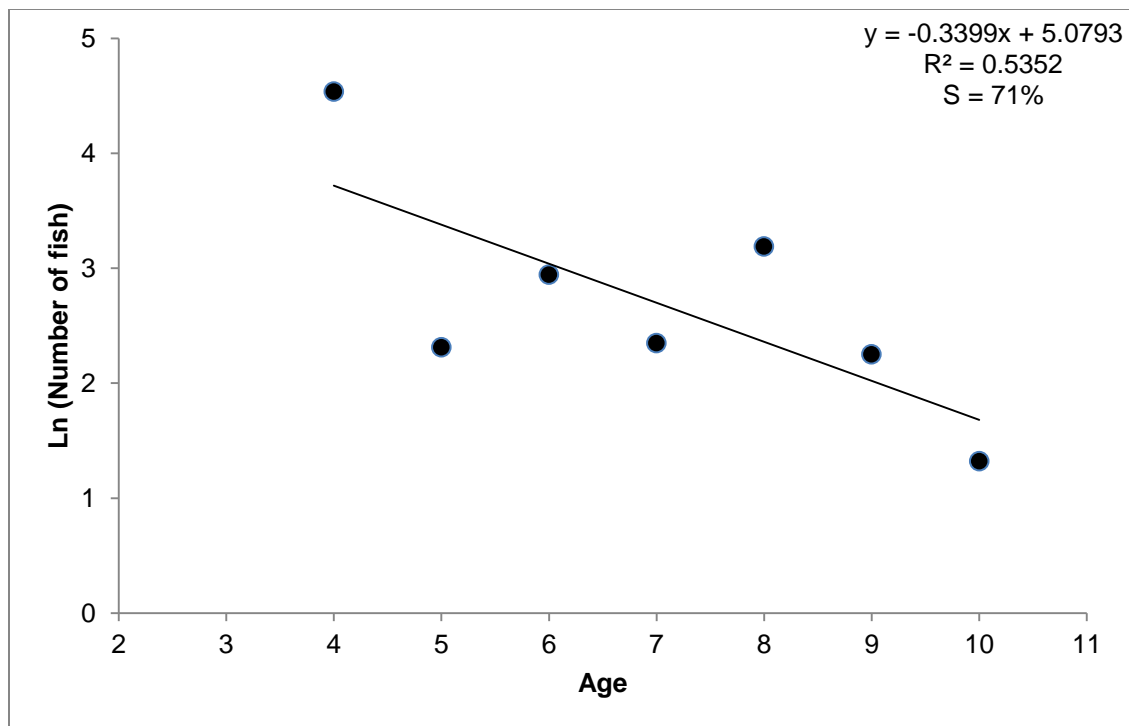


Figure 5. Total annual survival rate for adult walleye captured on North Sand Lake, Burnett County, Wisconsin in 2014.



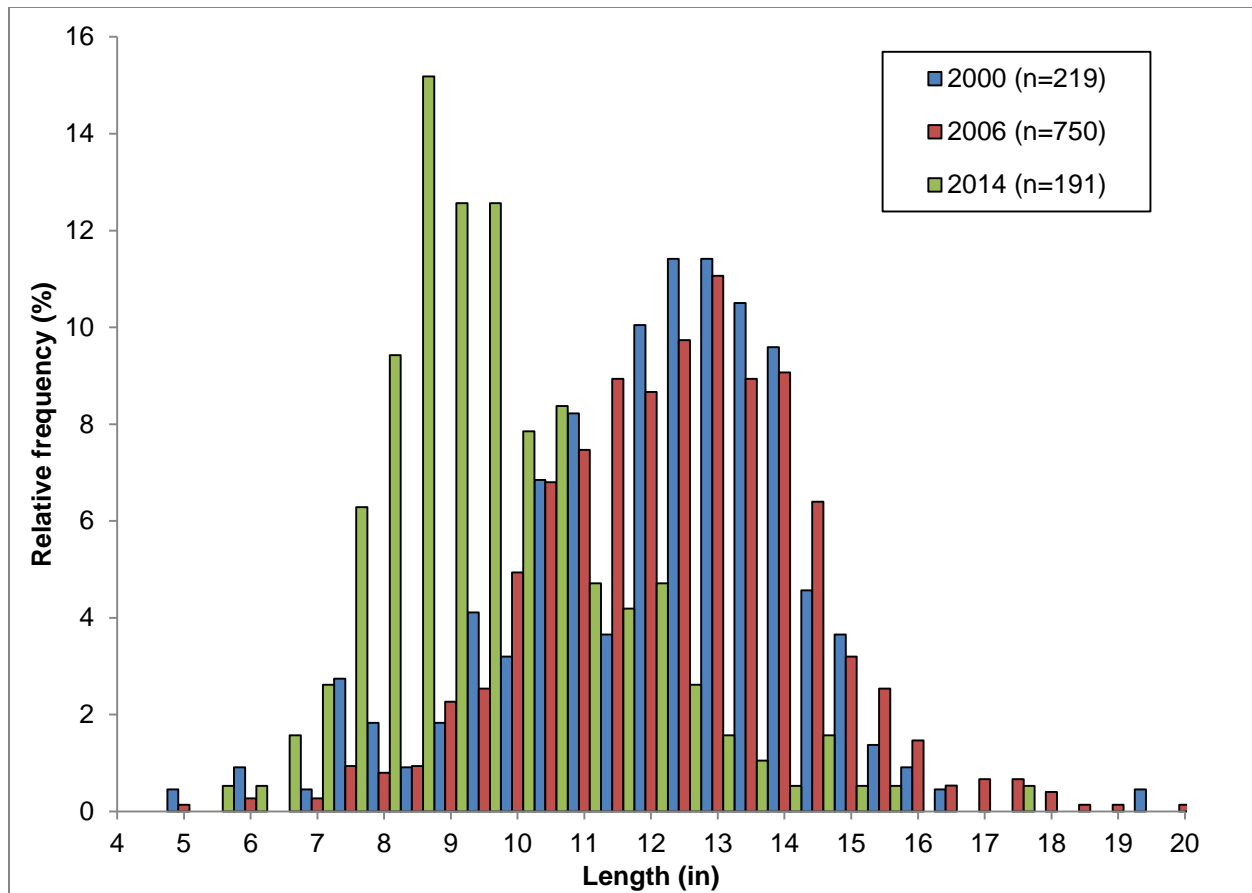


Figure 6. Relative length frequency of largemouth bass in North Sand Lake, Burnett County, during 2000, 2006, and 2014.

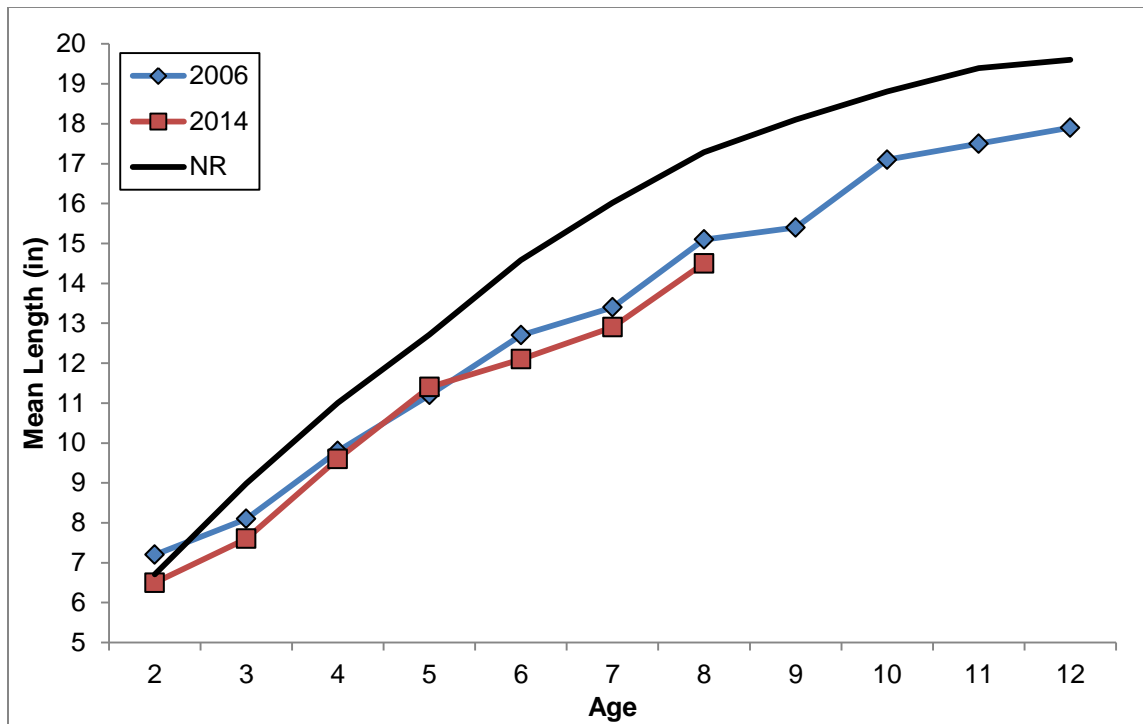


Figure 7. Mean length-at-age for largemouth bass captured on North Sand Lake, Burnett County in 2006 and 2014. The black line (NR) represents the Northern Region average.

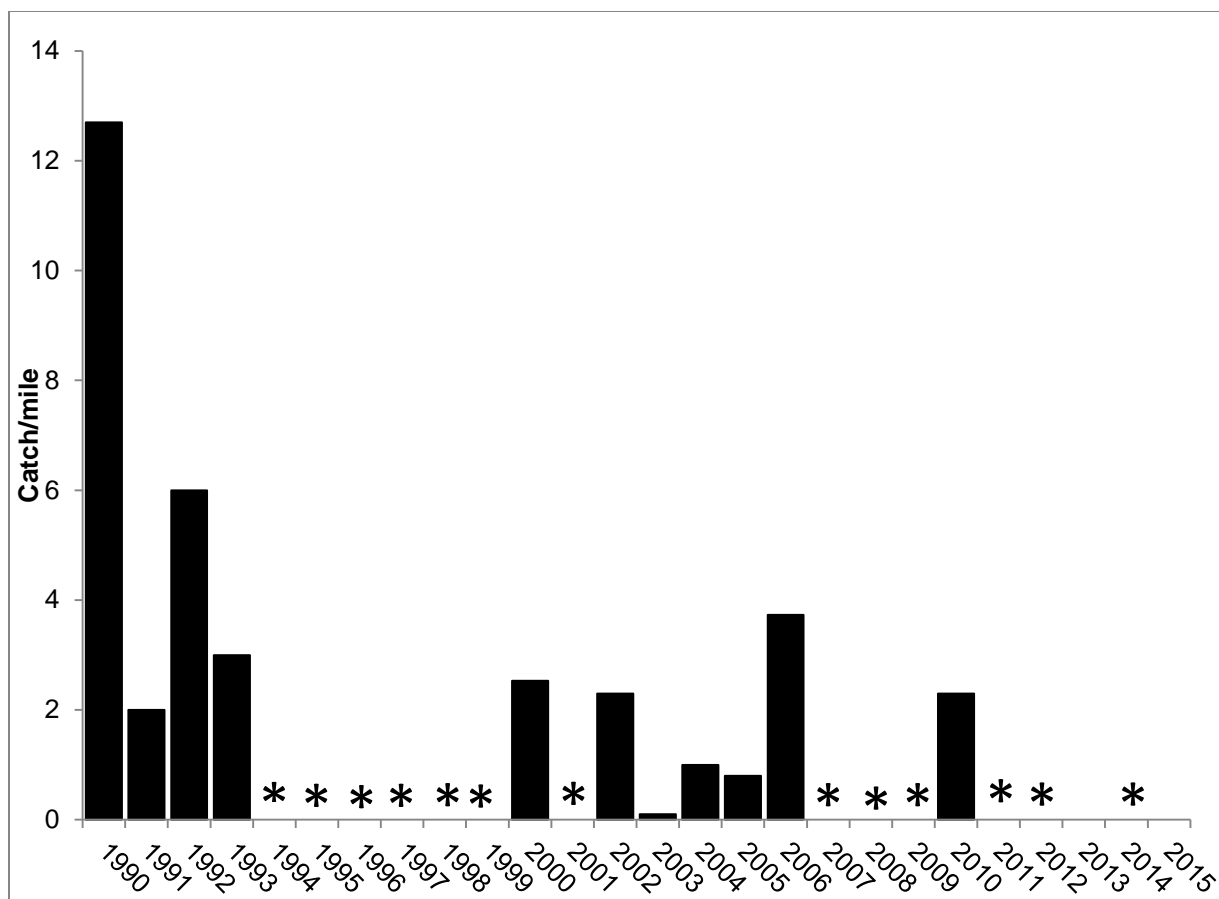


Figure 8. Young of year (YOY) walleye relative abundance determined by fall electrofishing surveys on North Sand Lake, Burnett County, Wisconsin. \* Represent years without a fall survey.

Appendix Table 1. Fish stocking records for North Sand Lake, Burnett County, Wisconsin, since 1994.  
 \* Field transfer.

Year	Species	Number of Fish Stocked	Average Length (in)	Source
1994	WALLEYE	18,966	2.6	TRIBAL
1994	WALLEYE	24,504	2.3	DNR
1996	WALLEYE	1,000,000	0.2	DNR
1996	WALLEYE	48,100	1.4	DNR
1996	WALLEYE	20,259	2.1	TRIBAL
1998	WALLEYE	48,100	1.6	DNR
1998	WALLEYE	14,430	2.1	TRIBAL
2000	WALLEYE	36,578	1.7	DNR
2000	WALLEYE	475	10.9	DNR*
2002	WALLEYE	219	7.3	TRIBAL
2002	WALLEYE	48,095	1.3	DNR
2002	WALLEYE	70,199	2.3	TRIBAL
2003	WALLEYE	8,837	2.1	TRIBAL
2004	WALLEYE	48,230	1.7	DNR
2004	WALLEYE	19,642	2.6	TRIBAL
2005	WALLEYE	4,052	3.0	TRIBAL
2006	WALLEYE	34,730	1.5	DNR
2006	WALLEYE	70,001	2.4	TRIBAL
2008	WALLEYE	33,908	1.4	DNR
2010	WALLEYE	755	6.2	TRIBAL
2010	WALLEYE	19,662	2.0	TRIBAL
2012	WALLEYE	3,117	7.6	DNR
2012	WALLEYE	3,770	2.0	PRIVATE
2014	WALLEYE	29,398	2.1	TRIBAL
2015	WALLEYE	13,505	7.5	DNR

Appendix Table 2. Values used in proportional stock density calculations.

Fish Species	Stock Size (in)	Quality Size (in)
Largemouth Bass	8	12
Walleye	10	15
Bluegill	3	6